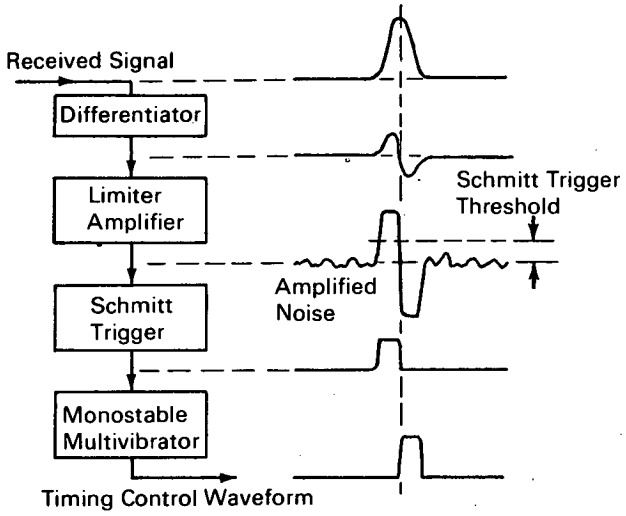
NASA TECH BRIEF

High-Accuracy Detector for Laser Radar



In developing a laser tracking and ranging system, a major design requirement was the ability to determine the distance to a retroreflector target within ±0.5 meter. This inferred that the arrival time of the reflected pulse be detected within ±3.3 nsec.

The wave shape of the received pulse is approximately Gaussian, with rise and fall times of 60 nsec and amplitude variations of 60 db. Because of these characteristics, the straightforward scheme of amplification and threshold detection would not produce the required accuracy.

A signal-processing technique has been developed that enables accurate timing of the pulse position independent of pulse amplitude. The technique, which is diagrammed above, consists of differentiating the received wave shape and coupling it to a zero-crossing detector. The differentiation produces a bipolar signal with a null point which corresponds to the peak of the received wave shape. This signal passes through a limiting amplifier, is converted to a constant-amplitude bipolar wave, and is fed to the input of a Schmitt trigger.

The Schmitt trigger is energized by the positive portion of the limiter output. It operates with a sufficiently high threshold to prevent triggering on noise or spurious signals. The trailing edge of the Schmitt trigger output in turn activates a monostable multivibrator, which produces a standard-width pulse whose leading edge corresponds with the maximum of the received signal. This pulse is used to stop the range counter. Using this technique, a 60-db variation in the amplitude of the received pulse produces only a 2-nsec time-shift in the leading edge of the stop pulse.

Note:

The following documentation may be obtained from:

Clearinghouse for Federal Scientific
and Technical Information
Springfield, Virginia 22151
Single document price $3.00
(or microfiche $0.65)

Reference:
NASA-CR-92485 (N70-92485), Tracking and Ranging System

Patent status:

No patent action is contemplated by NASA.

Source: G. Ammon of
RCA Corp.
under contract to
Manned Spacecraft Center
(MSC-13275)
Category 01